The Funnel Pelvis

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THE FUNNEL PELVIS.*

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(With two illustrations.)

Two years ago, following the routine mensuration of the pelvis in 1200 consecutive patients, I directed attention to the fact that contractions of the outlet occur much more frequently than is generally believed, and occasionally give rise to serious dystocia.

At that time after describing the various methods for estimating the width of the pubic arch, as well as for determining the length of the various diameters of the inferior strait, I designated as funnel, all pelves in which the transverse or antero-posterior diameters of the outlet were reduced from 11 or 11.5 cm. to 8 or 9 cm. or less, respectively. Furthermore, I distinguished between typical and generally contracted funnel pelves, according as the contraction is limited entirely to the outlet, while the other measurements remain normal, or as the abnormality is superadded to the general imperfect development which characterises the generally contracted or justo-minor pelvis.

I pointed out that the etiological factor concerned in the production of the former is usually found in the assimilation of the last lumbar vertebra to the sacrum whereby the latter consists of six vertebræ. This change in the sacrum frequently gives rise to alterations in the size and position of the articular portions of the bone which enter into the formation of the sacro-iliac joints; and, as a consequence, the innominate bones rotate about a horizontal axis in such a manner that their lower ends approach one another, thus leading to narrowing of the pubic arch and to shortening of the distance between the ischial tuberosities.

Typical funnel pelves were observed in 6.92 per cent. of the cases and were of equal incidence in both white and black women, while the generally contracted variety occurred only in 1.19 per cent. of the former, but was four times more frequent in the latter. In view of the unexpected frequency of these abnormalities, I urged that mensuration of the outlet be made an

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integral part of the routine pelvic examination of all pregnant women, and, whenever the pubic arch is found to be narrowed or the distance between the tubera ischii reduced to 8 cm. or less, that the anterior and posterior sagittal diameters of Klein should likewise be measured; since the prognosis depends not so much upon the absolute shortening of the transverse diameter, as upon the relation which it bears to the length of the posterior sagittal diameter.

During the past two years I have continued my studies in this direction, and have measured something more than 1000 additional pelves, so that I can now report upon the findings in 2215 women who were delivered at full term out of a series of 2750 consecutive patients passing through the obstetrical service of the Johns Hopkins Hospital (cases 2000 to 4750).

On this occasion, I shall consider the findings in the entire series, and compare them with those reported in my earlier paper, limiting my remarks, however, practically to the bearing of the typical funnel pelvis upon the course and conduct of labor, and referring only incidentally to the generally contracted and irregular types of funnel pelvis. I shall also consider the various methods by which the diameters of the outlet may be increased in case of need.

TABLE I.

Showing the frequency of the several types of abnormal pelvis in 2215 full term labors.

White.	Total No.	Percentage.	Spontaneous.	Operative.	Black.	Total No.	Percentage.	Spontaneous.	Operative.
Funnel	77	44.00	51	26	Generally contracted	158	42.02	145	13
Gen. contracted	48	27.43	37	11	Gen. cont. funnel	44	11.75	32	12
Gen. contracted funnel	12	6.86	7	5	Gen. cont. rhachitic	100	26.59	67	33
Simple flat	26	14.86	14	12	Funnel	58	15.23	51	7
General cont. rhachitic	7	4.00	4	3	Flat rhachitic	10	2.66	6	4
Atypical	4	2.88	2	2	Simple flat	4	1.06	4	0
Flat rhachitic	1	0.57	1	0	Atypical	2	0.53	1	1
Total	175	100.00	116	59	Total	376	99.99	306	70

Operative Frequency.

Usual types of contracted pelvis	33	operations in	98 whites,	33.98 per cent.
	63	"	in 318 blacks,	19.81 per cent.
Typical funnel pelvis	26	"	in 77 whites,	33.77 per cent.
	7	"	in 58 blacks,	12.07 per cent.

Frequency.—In the 2215 women—1313 white and 902 black—who had given birth to full term children, I found 135 typical funnel pelves, an incidence of 6.1 per cent. Of these seventy-seven occurred in white as compared with fifty-eight in black

women, an incidence of 5.87 and 6. 43 per cent. respectively. As these figures are practically identical with those which I reported two years ago—namely a total incidence of 6.92 per cent. and of 7.32 and 6.42 per cent. in the two races respectively, it would seem permissible to conclude that they are fairly accurate. In addition to these, twelve generally contracted funnel pelves were observed in the white and forty-four in the colored women,

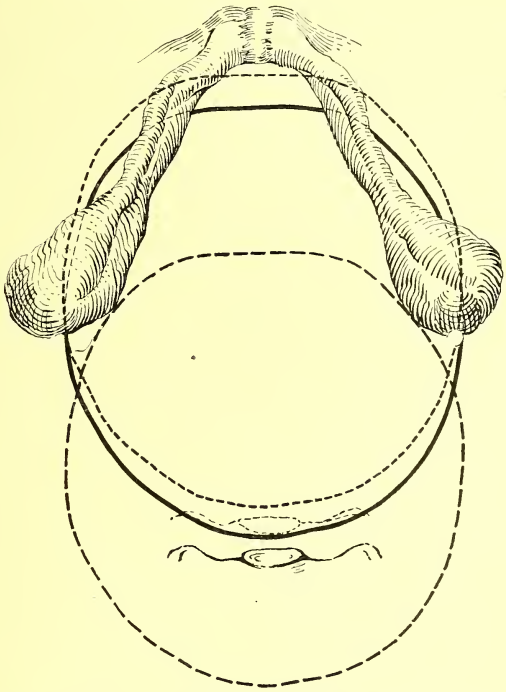

FIG. 1.—Diagram illustrating dystocia in funnel pelvis. $\times\frac{1}{2}$. ----- Head in usual position, spontaneous labor impossible. ——— Head with patient in exaggerated lithotomy, or Sim's position. Spontaneous labor impossible. — — — Head in position it must assume in order to be born spontaneously, which is only possible with marked increase in the length of posterior sagittal diameter.

an incidence of 0.9 and 4.88 per cent respectively, which is in close accord with my previous findings which showed an incidence of 1.19 and 4.91 per cent. respectively.

Table I, gives the frequency with which all types of contracted pelvis were observed in the series, and shows that in addition to the seventy-seven funnel pelves there were ninety-eight examples of the several varieties of contractions of the pelvis inlet in the 1313 white women, as compared with fifty-eight and 312 n the 902

black women—a total incidence of 13,33 and 40.93 per cent. respectively. As the usual types of contracted pelvis were noted in 7.46 per cent. of the former and 34.5 per cent. of the latter, it is evident that they occur nearly five times more frequently in black than in white women. Furthermore, when we consider that typical funnel pelvis were also present in 5.87 and 6.43 per cent. of the cases, respectively, it would appear that they are of relatively greater importance in the white race, in which they constitute 44 per cent. of all abnormal pelves, as compared with 15.23 per cent. in the black race. In other words, they represent the most common variety of contracted pelvis in white women, while they only rank fourth in order of frequency in black.

As was pointed out in my previous paper, these findings are of great interest in connection with the etiology of outlet contractions. The fact that the usual types of contracted pelvis occur four or five times more frequently in colored women renders it highly probable that the explanation for the difference must be sought in certain conditions peculiar to that race, and, from the study of colored women as seen in my service, these would appear to consist in imperfect general development and rhachitis, which may be regarded as resulting from the imperfect nutrition and poor hygienic conditions under which the colored women live in large cities. On the other hand the fact that typical funnel pelves occur equally frequently in the two races, inevitably leads to the conclusion that the etiological factor concerned in their production must be sought in some condition which is common to both, which, as I have already indicated, usually consists in lumbosacral assimilation.

On the other hand, I am inclined to regard the generally contracted funnel pelvis as merely an exaggeration of the imperfect general development of the entire pelvis, and consider that the outlet contraction is rarely associated with lumbo-sacral assimilation. For this reason, I do not regard the generally contracted funnel pelvis as a distinct type, but consider it merely a variety of the justo-minor pelvis. Upon counting the two together, my figures show that they make up 34.29 and 53.72 per cent. of all pelvic abnormalities in the two races respectively.

Effect upon Labor.—Fortunately, for its effect upon the course of labor, the typical funnel pelvis usually presents only a moderate degree of contraction. Thus, in the seventy-seven white women the distance between the tubera ischii measured

8 cm.	in 57 cases,
7.5 cm.	in 14 cases,
7 cm.	in 6 cases,

as compared with the following measurements in the fifty-eight colored women:

8 cm.	in 40 cases,
7.5 cm.	in 14 cases,
7 cm.	in 1 case,
6.5 cm.	in 1 case,
6 cm.	in 1 case,
5.5 cm.	in 1 case.

Accordingly it would appear that extreme degrees of contraction are more frequently noted in the latter.

That the abnormality may have a serious effect upon the course of labor, especially in white women, is shown by the fact that operative interference was necessary in twenty-six of the seventy-seven white, as compared with seven of the fifty-eight colored cases, an incidence of 33.77 and 12.07 per cent. respectively. Moreover, as in the same series of cases the operative frequency in the usual types of contracted pelves was 33.98 and 19.18 per cent. respectively, we are compelled to admit that contractions of the pelvic inlet and of the outlet are of almost equal importance in the causation of dystocia in white women, but to a somewhat less extent in the black women.

The recognition of these facts is of very considerable practical importance and clearly demonstrates the necessity for the prompt diagnosis of such abnormalities. Moreover, it is interesting to note that operative interference is comparatively less frequently required in the colored race, notwithstanding the greater incidence of the more marked types of outlet contraction which characterize it; and the observation would seem to indicate that the difference must be due to some condition peculiar to black women.

Upon analyzing the histories of our cases, I believe that an explanation is afforded by the smaller size of the colored child, whose average weight is 2952 grams as compared with 3205 grams for the white child, a difference of 247 grams, or a little more than half a pound. Moreover the difference is still further accentuated in the operative cases, as it is found that the white children weigh on the average 3078 and 3468 grams respectively, according as

they are born spontaneously or delivered after operative interference, whereas there was no material difference in the colored race. These findings indicate that in the operative cases the white children average 500 grams heavier, a difference which is quite sufficient to explain the greater necessity for operative interference.

Upon analyzing the operative cases more closely, it is found that in nine of the white women and in two of the black women the indication for interference was quite independent of the outlet contraction, thus leaving seventeen white women and five

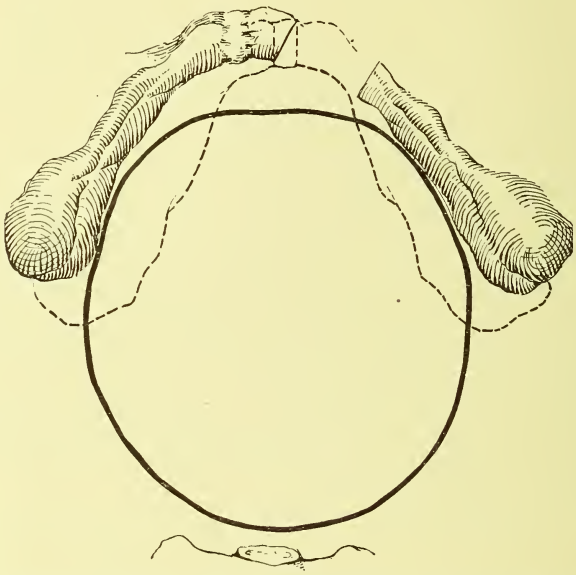

FIG. 2.—Diagram illustrating effect of pubiotomy in a pronounced funnel pelvis. Dotted lines show pubic arch before operation. $\times \frac{1}{2}$.

colored women in which the funnel pelvis itself was the cause of the dystocia. This represents an incidence of 22.8 and 8.26 per cent. and indicates that operative interference is necessary in approximately every fifth white woman and every twelfth black woman presenting a typical funnel pelvis. That the dystocia is not insignificant is shown by the fact that in the twenty-two instances in which it was sufficiently pronounced to demand interference, the following operations were necessary: one Cesarean section, three pubiotomies, one craniotomy one mid forceps and sixteen low forceps.

In my former article I emphasized the part played by outlet contraction in the production of severe perineal tears, and further

observation only serves to confirm that opinion. In the 135 cases there were seventy-five perineal tears, an incidence of 55.5 per cent. In themselves such figures are not particularly striking as they are hardly higher than those observed in normal pelves, but upon analyzing them more closely, the effect of the funnel pelvis becomes manifest, as the tears were of the second degree in thirty-two cases and extended through the sphincter ani in three others.

In the entire series of cases there were no maternal and nine fetal deaths. Two of the latter were clearly due to the pelvis, as in one craniotomy was necessary in order to permit the extraction of the aftercoming head, while in the other death occurred on the eleventh day from meningitis, resulting from injuries sustained by the head at the time of labor. In the other seven cases, fetal death was not connected with the pelvic deformity, as two of the children died on the ninth and tenth days, respectively, with negative autopsies, one died on the eleventh day from broncho-pneumonia and two from syphilis, one from prolapse of the cord complicating a shoulder presentation and one from premature separation of the normally implanted placenta. This corresponds to a gross and net fetal mortality of 6.66 per cent, and 1.5 per cent, respectively, and should be regarded as highly satisfactory.

Prognosis.—As indicated in my former article, I consider a transverse diameter of eight cm. the boundary line between the normal and contracted outlet, but the mere extent of the shortening in the bis-ischial diameter gives no indication as to the prognosis, as I have observed serious dystocia with a transverse diameter of eight cm. and easy spontaneous labor when the same diameter was reduced to 5.5. cm. Similar observations were made by Klien, who pointed out in his monograph, which appeared in 1896, that the prognosis depended not so much upon the absolute size of the transverse diameter as upon its relation to the posterior sagittal diameter of the outlet, namely, the distance between the center of the former and the anterior surface of the tip of the sacrum.

Based upon the study of 113 normal pelves, Klien he concluded that the normal outlet should present the following measurements:

Transverse	11 cm.
Anterior sagittal	6 cm.
Posterior sagittal	9.95 cm.
Anteroposterior	11.5 cm.

Two years ago I stated that, although practically identical methods of mensuration were employed, our results did not correspond, as my measurements were considerably smaller. At that time I was unable to offer an explanation for the discrepancy, nor can I do so at present.

More extended observation has served to confirm my previous findings, and in 185 apparently normal pelves, in which the distance between the tubera ischii measured 10 cm, or more, I obtained the following average measurements, after deducting 1 cm. for the thickness of the tip of the sacrum in the case of the last two diameters.

Transveres	10.5 cm.	(10.41)
Anterior sagittal	5 cm.	(5.15)
Posterior sagittal	7.5 cm.	(7.52)
Anteroposterior	11.5 cm.	(11.35)

Notwithstanding these differences, I thoroughly endorse Klien's theoretical deductions concerning the significance of variations in the several diameters, but at the same time I cannot agree with his conclusions as to their effect upon the course of labor. He stated that a spontaneous termination could not be expected when the distance between the tubera ischii measures 8 cm. unless the posterior sagittal is at least 9 cm. long. As this considerably exceeds its length in my normal cases, it should follow, if his conclusions were correct, that the majority of my patients with funnel pelves should have presented serious dystocia. Since this was not the case, I feel justified in assuming that he was in error, or at least that his method of mensuration did not give the same results as mine.

However this may be, I consider that a reduction of the distance between the tubera ischii to 8 cm. should be regarded as a danger signal which imperitively demands the mensuration of the posterior sagital diameter, but does not necessarily indicate dystocia. In private practice I ordinarily approximate the degree of outlet contraction by palpating the pubic arch, since with a little practice one soon learns to classify it as normal, narrow or very narrow. In the first case accurate mensuration is not necessary, while in the second the transverse diameter should be measured, and whenever it is 8 cm. or less all of the other measurements should be made.

In my former article I attempted to give an idea as to what might be expected with certain outlet measurements, and

stated that spontaneous labor would he exceptional with the following measurements:

Distance between tubera ischii 8 cm., posterior sagittal 7.5 cm.
Distance between tubera ischii 7 cm., posterior sagittal 8 cm.
Distance between tubera ischii 6.5 cm., posterior sagittal 8.5 cm.
Distance between tubera ischii 6 cm., posterior sagittal 9 cm.
Distance between tubera ischii 5.5 cm., posterior sagittal 10 cm.

Further experience in general demonstrates the correctness of my figures, which, however, should be considered as merely approximate and not absolute; as the prognosis will depend not only upon the dimensions of the outlet, but also upon the size and consistency of the child's head. Thus, in one of my patients a child weighing 4915 grams was expelled spontaneously through an outlet whose transverse and posterior sagittal diameters measured 6.5 and 9 cm. respectively, while in another case presenting similar measurements pubiotomy was required, Accordingly, while my increased experience has not enabled me to lay down definite rules, it has clearly taught me that spontaneous labor is not likely to occur unless the posterior sagittal diameter increases proportionately as the distance between the tubera ischii decreases, somewhat as indicated in the preceding table.

Under such conditions the primiparous patient should be treated expectantly, but the possibility should always be borne in mind that we may be obliged to resort to some major obstetrical operation, in order to avoid fracture of the skull during a low forceps operation, or the performance of craniotomy. Of course in multiparous women in whom the history of previous labors is available a primary Cesarean section may be undertaken with a good conscience.

Artificial Variations in Antero-posterior Diameters.—During the past year I have learned that the antero-posterior and posterior sagittal diameters of the outlet do not represent fixed values, but that they vary materially according to the position of the patient. The recognition of this fact is of great practical importance, since in the less marked grades of deformity it places in our hands a means of reducing the necessity for operative interference.

My attention was directed toward this possibility by the follow ing observation: In a primiparous patient with a moderately contracted outlet, presenting a transverse and a posterior sagittal diameter of 7.5 and 8 cm. respectively, the head was visible at

the vulva for one and a half hours without advanicng in spite of strong second stage pains. I then determined to complete delivery by low forceps, and placed the patient upon a table with her legs sharply flexed upon the abdomen, and held in position by means of a leg holder. While I was washing my hands, I was surprised to see the labor make rapid progress and end spontaneously with the birth of an 8-pound child.

When I attempted to find an explanation for this unexpected outcome, I was forced by a process of exclusion to conclude that it was due to an enlargement of the outlet resulting from the position of the patient. This in all probability led to rotation of the innominate bones at the sacro-iliac joints, whereby the symphysis moved upward, while the tip of the sacrum retained its original position, thus leading to a lengthening of the antero-posterior and posterior sagittal diameters of the outlet.

With this idea in mind I began a series of experiments in order to determine its correctness, and in case it were verified, to ascertain to what extent enlargement was possible. Accordingly, I measured the outlets of 106 women with normal pelves in the ordinary obstetrical position, and immediately afterwards repeated the measurements with the legs flexed sharply against the abdomen, bringing the knees almost in contact with the shoulders, and at the same time slightly abducting the thighs. I was surprised to find that in no instance was the transverse diameter affected, but that the vast majority a very considerable enlargement of the antero-posterior diameters occurred. This was less marked in the posterior sagittal diameter than in the distance between symphysis and the tip of the sacrum. I do not consider this remarkable, for the reason that the latter diameter can be measured with great accuracy, but the former only approximately, as it is impossible to be sure that the transverse bar of the outlet pelvimeter is always placed exactly in the same location.

In the entire series the increase in the antero-posterior diameter varied from zero to 4 cm. and averaged 1.75 (1.73)cm., while the posterior sagittal diameter presented an average increase of 0.75 (0.73) cm. The changes in the former are shown by the following table:

Increase of	0 cm.	in	1 case.
Increase of	0.5 cm.	in	4 cases.
Increase of	1. cm.	in	22 cases.

Increase of 1.5 cm. in 31 cases.
Increase of 2 cm. in 27 cases.
Increase of 2 cm. in 27 cases.
Increase of 2.5 cm. in 11 cases.
Increase of 3 cm. in 8 cases.
Increase of 3.5 cm. in 1 case.
Increase of 4 cm. in 1 case.

This shows that in ninety-one of the 106 observations the increase varied from 1 to 2.5 cm.

At the same time we had an opportunity to test the effect of change of position in five women presenting funnel-shaped pelves, with the following results:

I. Tubera ischii 6.5 cm., antero-post. increased 1 cm., post. sagittal .05 cm.

II. Tubera ischii 7.5 cm., antero-post. increased 1.5 cm., post. sagittal 0.5 cm.

III. Tubera ischii 8 cm., antero-post. increased 2 cm., post. sagittal 1.5 cm.

IV. Tubera ischii 8 cm., antero-post. increased 1 cm., post. sagittal 1.5 cm.

V. Tubera ischii 8 cm., antero-post. increased 1 cm., post. sagittal 0 cm.

These observations therefore indicate that in both normal and funnel shaped pelvis it is possible to increase the antero-posterior diameter of the outlet very materially by changing the position of the patient. As the enlargement can be explained only by the rotation of the innominate bones about the sacrum, it is apparent that the anterior sagittal diameter will undergo no change, but that the entire increase in the length of the antero-posterior diameter must occur posterior to the tubera ischii, which consequently adds materially to the length of the posterior sagittal diameter. In many patients with a contracted outlet such a degree of enlargement should be sufficient to make spontaneous labor possible, whereas interference would be necessary were the ordinary obstetrical position maintained. Moreover, this is illustrated by the satisfactory results obtained following low forceps operations in many patients in whom the relation between the transverse and posterior sagittal diameters was such as to render such an outcome theoretically improbable. In such cases, the mere change of posture led to sufficient enlargement of the posterior sagittal diameter to make possible the birth of the child.

I do not wish to appear to claim that this observation is original, but I desire to direct attention to the very practical bearing upon the conduct of labor complicated by moderate degrees of funnel pelves. As early as 1854, Matthews Duncan described the rotation of the innominate bones about the sacrum and stated that it would increase the outlet measurements by a few lines. Moreover he expressed the belief that the flexed position which many patients assume during difficult labor is an unconscious attempt to bring this about. With the exception of a short contribution by Zaglas, his observation was practically forgotten until 1889, when the appearance of Walcher's publication concerning the effect of the hanging position upon the size of the pelvis led to renewed investigation in this regard. One of the most important contributions to the subject was made by Klein and at the Congress of Gynecology and Obstetrics held in Amsterdam in 1889 it was the main theme for discussion. Klein stated that Walcher's position led to a slight increase in the length of the conjugata vera and to a decrease in the antero-posterior diameter of the inferior strait; but that on the other hand the condition was reversed when the patient was placed in the exaggerated lithotomy position, the inlet becoming relatively contracted and the outlet enlarged. At the same time similar results were also reported by Bonnaire and Bué, Lebedeff and Bartoszewicz, Bar and others.

Bonnaire and Bué stated that in favorable cases the exaggerated lithotomy position might lead to an increase of 16 or 18 mm. in the length of the antero-posterior diameter of the outlet, and therefore, suggested that extreme flexion of the thighs upon the abdomen would probably be useful in certain cases of brow presentation, as well as in moderate degrees of kyphotic pelvis. Likewise, Samuels in a clinical contribution in 1907 stated that he made it a rule to place his patients in such a position before applying forceps, and noted that in many instances spontaneous labor occurred without difficulty. He also reported similar results in a few cases of face and occipito-posterior presentation, as well as in certain funnel-shaped pelves.

Last autumn Devraigne and Descomps stated that it was possible to bring about a certain degree of enlargement in the transverse diameter of the outlet by a similar posture, although they believed that the effect would be augmented if the legs were

extended and somewhat abducted before being flexed at the hip joint. They attributed the increase to the traction exerted upon the ischio-pubic rami and the tubera ischii by the large muscles of the thigh, which were brought into a condition of extreme tension by the position. They failed to support their statements by measurements, but merely stated the anatomical facts and commended the method to practical obstetricians. Immediately after the appearance of their article, Van Rooy stated that a similar procedure had been employed for several years in Treub's clinic, and that Jonges had reported his results to the Dutch Gynecological and Obstetrical Society in 1908. Upon that occasion he held that the transverse diameter of the outlet could be enlarged by 3.5 to 9 mm. by such means, and suggested its application in certain cases of funnel pelvis. Moreover, it is interesting to note that Duncan mentioned that Laborie in 1862 claimed to have obtained similar results.

I have experimented with the posture of Jonges and Devraigne and Descomps, but have not been able to confirm their results, as I failed to note any appreciable enlargement in the transverse diameter. At the same time I obtained the same degree of increase in the antero-posterior diameter as when the legs were sharply flexed upon the abdomen and slightly abducted.

Unfortunately, the exaggerated lithotomy position cannot be maintained for any length of time, except when the patient is under the influence of anæsthesia and for this reason it is not available in the majority of cases. On that account I have attempted to find some substitute for it, and it seemed to me that a squatting posture would probably have the same effect. Such a position, however, would scarcely be compatible with a proper aseptic technic, while at the same time it would be impossible to control the extent of enlargement by accurate mensuration.

As the employment of the exaggerated lithotomy and squatting posture was practically out of the question, it occurred to me that similar results might be obtained with the patient in a modified Sims' position, but with the legs even more sharply flexed than usual. Accordingly during the past few months, I have tested the effect of this posture upon all my patients at the time of discharge and found it gave exactly the same degree of enlargement in the antero-posterior diameters of the outlet as the exaggerated lithotomy position. As it is possible

for a patient to maintain such a position for an indefinite period, it would appear to be the ideal method for the treatment of labor complicated by moderate degrees of typical funnel pelvis. It is not necessary to give the measurements obtained, as they are identical with those already reported in connection with the exaggerated lithotomy position.

I consider that this observation is of very considerable practical importance and that it emphasizes in an unexpected manner the advantages of the exaggerated Sims' position for delivery. It not only brings about a degree of enlargement of the antero-posterior and posterior sagittal diameters sufficient to permit the spontaneous termination of labor which would be impossible in the ordinary obstetrical position, but at the same time it should diminish the frequency of deep perineal tears by the same mechanism. At present, I have not delivered a sufficient number of women with funnel pelves in this position to attempt to adduce by statistical evidence as to its value, but as I do know what it can accomplish in the living woman, to that I feel that I can recommend it to you for trial.

Effect of Pubiotomy Upon Funnel Pelves.—Last year I reported the results obtained in twenty-five pubiotomies performed for dystocia resulting from various types of contracted pelvis, and since then ten additional operations have been performed in my clinic. With a few exceptions, each of the thirty-five patients have been examined one or more times at varying periods after their discharge, so that I know whereof I speak when I say that the results were all that could be desired.

The after study of the patients have revealed several facts which are of great interest in connection with the treatment of funnel pelves. As indicated upon a previous occasion, the healing of the bone wound practically always occurs by fibrous rather than by bony union, with a resulting pseudo-arthrosis. This does not interfere with locomotion, and in a certain proportion of cases brings about a slight permanent increase in the length of the conjugata vera. Moreover, in a much larger number of cases, it results in a considerable increase in the size of the transverse, but does not usually effect the antero-posterior diameter of the inferior strait. Such an increase was noted in sixteen of the thirty-five cases, and varied from 1 to 3 cm., averaging 1.62 cm. for the entire series. Of course, in the ordinary types of pelvic deformity such an increase is only of theoretical interest, whereas in funnel pelves it is of the great-

est practical importance in that it may serve to convert the previously contracted outlet into a normal one, and thus not only overcome the immediate dystocia but make it possible for the patient to have subsequent spontaneous labors.

In my series of pubiotomies, there were three typical funnel and two generally contracted funnel pelves. In the former, the operation led to a permanent increase in the distance between the tubera ischii from 7 to 8, from 7 to 9.5, and from 6 cm. to 9 cm. respectively: an increase of 1, 2.5 and 3 cm. This means that in the first case the comparatively pronounced funnel pelvis was converted into one of only slight degree, while in the other two the marked contraction was so entirely overcome that the pelvis became normal. In the first of the two generally contracted pelves, the distance between the tubera ischii was increased from 7 to 8 cm. and in the second from 7.5 to 8.5 cm. Consequently, in the first case the comparatively marked outlet contraction was transformed into a slight one, while in the second a normal outlet was obtained.

These observations are of the greatest practical interest and demonstrate conclusively that pubiotomy is the operation of choice whenever a typical funnel pelvis gives rise to serious dystocia and requires radical operative interference, as it not only affords us a means of effecting delivery at the time, but offers a considerable probability of converting the abnormal into a normal pelvis, and thus rendering possible a spontaneous outcome in subsequent labors.

The beneficent effect of pubiotomy was strikingly illustrated in the subsequent labor of Case XVII, described in my pubiotomy article of last year. At the time of the first labor, we had to deal with a typical funnel pelvis, with a transverse and posterior sagittal diameter of 7 and 8 cm. respectively, and a child weighing 3430 grams was delivered by pubiotomy after an ineffectual attempt at delivery with forceps. The patient made a satisfactory recovery, and was dismissed in good condition with the distance between the tubera ischii increased to 8.25 cm. She soon became pregnant again, and was very much alarmed at the outlook. I reassured her and told her that as a result of the operation her pelvis had become normal, and in all probability would become still larger at the time of labor. My prediction was fully confirmed. Examination one month before the expected date of confinement showed that the distance between the tubera ischii had become increased to 8.5 cm.

She had an easy spontaneous labor, and the child weighed 4140 grams, or 700 grams heavier than on the previous occasion. The second stage was so rapid that the child would have been born before my arrival at the hospital had not my assistant retarded its advance by the administration of chloroform. At the time of delivery, the distance between the tubera ischii measured 10 cm. but had become reduced to 9.5 cm. when the patient left the hospital. At that time her condition was excellent, locomotion was normal and the extensive fibrous union at the pubis gave no discomfort although she was a large stout woman.

The conversion of a funnel into a normal pelvis following pubiotomy is likewise well illustrated by the following case (4707) which is of additional interest from the fact that the enlargement of the outlet was not limited to the transverse diameter, but involved the antero-posterior as well.

The patient was a stout colored woman, who had previously given birth to three macerated children, and was admitted to the hospital after having been in labor for over twenty-four hours. At that time the membranes were ruptured, the cervix two thirds dilated and a large child presenting in L.O.P. with the head two fingers above the ischial spines. The usual pelvic measurements were normal, but the outlet was markedly contracted and presented the following dimensions: distance between tubera ischii 6.5 cm. anterior and posterior sagittal 6 and 8 cm. respectively, and antero-posterior diameter 10.5 cm. Complete dilatation of the cervix occurred a few hours later; and at the same time marked amaurosis developed and the urine was found loaded with albumen, while the temperature had risen to 100.4 F. When I saw her shortly afterwards, I felt that immediate delivery was indicated and could be most conservatively effected by pubiotomy, as the elevated temperature contraindicated Cesarean section, which would otherwise have been chosen on account of the size of the child and the patient's desire for living offspring.

Accordingly, the left pubic bone was sawed through, and and the child delivered after a most difficult Scanzoni forceps operation, during which the cut ends of the bone gaped 6 cm. and a second degree perineal tear was sustained. The somewhat asphyxiated child was soon resuscitated, and presented a marked caput, but no apparent injury to the skull. It was 56 cm. long, weighed 4915 grams and presented the fol-

lowing head measurements: 15.75, 13.5, 10, 10.25 and 8 cm. A lead tape tracing of its head applied over a diagram of the pelvic outlet showed the absolute impossibility of spontaneous labor, and the justification for interference. The child died on the fourteenth day from meningitis, but the mother made a good recovery and was discharged in excellent condition on the twenty-seventh day. At that time locomotion was normal in spite of marked motility at the site of the bone wound, and the outlet measurements, which had undergone marked change, were as follows: distance between tubera ischii 9 cm., anterior and postorior sagittal 6 and 8 cm. respectively, and antero-posterior diameter 12 cm. In other words, the transverse diameter had become increased by something more than 2.5 cm. and the antero-posterior by 1.5 cm., so that the markedly contracted funnel pelvis had become transformed into a normal one. In view of this, and the fact that the bone wound had healed by fibrous union, there is every probability that still further enlargement may occur as the result of the hyperemia incident to a subsequent pregnancy, and thus permit spontaneous delivery.

These observations conclusively demonstrate the value of pubiotomy in the class of cases under consideration, as they show that it not only copes with the existing dystocia, but in addition offers a reasonable probability of permanently overcoming the outlet contraction and thus making possible the spontaneous termination of subsequent labors.

For this reason, I consider it the operation of choice in all cases of funnel pelvis in young women which require radical interference. The case is not so clear in elderly primiparæ, or in women who present a history of several previous labors which have ended disastrously. In such cases every effort should be made to save the child, so that it would seem better to perform elective Cesarean section at an appointed time rather than to expose it to the comparatively slight dangers following pubiotomy, and to leave out of consideration any effect which the latter operation might have upon the course of subsequent labors.

CONCLUSIONS.

1. In typical funnel pelves the distance between the tubera ischii is reduced to 8 cm. or less, while the usual measurements remain unchanged.

2. Such pelves were noted in 6.1 per cent. of 2215 consecutive full term labors, are of equal incidence in white and black women and sometimes give rise to serious dystocia.

3. The funnel pelvis is the most common abnormality in white women, in whom it constitutes 44 per cent. of all deformed pelves. In colored women on account of the greater incidence of the more usual types, it is relatively less important, and stands fourth in order of frequency.

4. The prognosis depends not so much upon the actual narrowing of the pubic arch or upon the distance between the tubera ischii as upon the relation between the latter and the posterior sagittal diameter.

5. Moderate degrees of dystocia can frequently be overcome by placing the patient in an exaggerated lithotomy or an exaggerated Sims' position. In either event the antero-posterior and posterior sagittal diameters undergo an average increase of 1.62 cm. which may so increase the available space as to make spontaneous labor possible.

6. Such an enlargement affords an explanation for the successful outcome of certain low forceps operations, which appear theoretically impossible from the measurements taken in the usual position.

7. Pubiotomy is the operation of choice in cases of pronounced dystocia, as it not only effects the delivery of the child, but leads to a permanent increase in the size of the outlet, which may be further enlarged by the softening of the fibrous union under the influence of the hyperemia incident to pregnancy, and thus make possible the spontaneous termination of subsequent labors.

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